DOCUMENT RESUME

ED 256 341 IR 011 661

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TITLE Notetaking Activity as a Logical Classroom Learning Strategy.
PUB DATE Jan 85
NOTE 12p.; Paper presented at the Annual Convention of the Association for Educational Communications and Technology (Anaheim, CA, January 17-23, 1985). For entire proceedings, see IR 011 621.
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Analysis of Variance; College Freshmen; *Concept Formation; Higher Education; *Illustrations; Instructional Design; *Intermode Differences; Learning Processes; Learning Strategies; *Notetaking; Performance; *Spatial Ability; Writing Skills
IDENTIFIERS *Directed Overt Activity Strategy

ABSTRACT

The impact on learning performance of a notetaking strategy called the Directed Overt Activity Strategy (DOA) was evaluated on three types of instructional tasks: spatial learning, simple concept learning, and complex concept learning. One hundred volunteer freshman psychology students from Ohio State University used either the DOA or their own covert, internal learning strategy while learning from printed materials, which consisted of an illustrated workbook providing information about the human heart and containing either an illustration-type drawing or a line drawing. Results indicated that visual drawing type differences did not affect learning and had no effect on the type of learning strategy used. However, there was a significant interaction between the intellectual task and the strategy used. While both groups performed well at the less difficult side of the intellectual task scale, the DOA strategy allowed subjects to identify important information to help them perform on the more difficult intellectual task. Eleven references are listed. (LMM)

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Notetaking Activity as a Logical Classroom Learning Strategy

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Presented at the AECT Convention, Anaheim, California, January 1985. Paper of the presented research study published in the AECT-Research and Theory Division Proceedings.

IR011661

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Notetaking As a Learning Strategy

The most prevelant learning strategy used among college level learners is the external learning strategy of notetaking. An external learning strategy is defined as one involving an external behavioral activity such as: writing paraphrased ideas, developing hypothesis, developing an illustration of a concept, the verbatim writing of the presentation, or underlining. While an external strategy involves overt behavior, an internal learning strategy involves the covert mental manipulation of instructional information. A commonly used internal strategy to aid learning is the mnemonic memory device (Bower, 1973). A number of internal learning strategies involving covert mental manipulation, such as imagery mnemonics, have been investigated (O'Neil, 1978; Rohwer, 1970; Danserea., 1979; Bugelski, 1970; Paivio, 1970), indicating that internal strategies can improve learning. While both external and internal types of learning strategies can be effective, in aiding learning, the external strategy of notetaking is the most extensively used by college learners. A recent survey involving over 800 undergraduate engineering students, representing a variety of engineering disciplines, revealed that notetaking is the primary method of abstracting information during class for later study (Canelos, 1983). This result also seems to apply to notetaking activities during the study of text material and other types of printed instructional materials. Additionally, undergraduates seem to be sensitive regarding attempts at changing their notetaking behaviors, if such attempts are made to improve notetaking efficiency. This would indicate that undergraduate students are conscientious about notetaking, and therefore consider notetaking strategies vital to their learning. For example, after using an innovative teaching strategy, aimed at improving notetaking during lectures, Kilareski, Canelos, and Reinschmidt (1982) found that students had strong attitudes regarding the new notetaking strategy.

While the notetaking strategy appears to be extensively used by learners, little is actually known about what types of notetaking strategies are better for acquiring specific types of intellectual skills such as: factual learning, conceptual learning, rule application, and problem solving. Furthermore, past research does not yield a great deal of information regarding how notetaking is operationally contributing to the learning process from a cognitive processing perspective (Ganske, 1981). The present study attempts to address this problem by operationally defining a notetaking strategy as a method of separating relevant to-be-learned material from background information given in instruction. This separation of relevant material for a specific intellectual skill, from irrelevant material seems to be the key information processing function of the notetaking activity. Hartley and Davies (1976) indicated three functional activities involved in notetaking:

1. identify and discriminate elements;
2. identify and discriminate the relationships of those elements;
3. identify how information is organized (Hartley and Davies, Note 1, p. 27).

The first two of these activities involve the behavior of separating what is relevant, and must be learned, from what is background information in the lesson.

The notetaking strategy used in the present study was called the directed overt activity strategy (DOA). The DOA notetaking strategy aided the learner in separating relevant information that had to be learned from irrelevant information. Learning performance using the DOA strategy was evaluated on three types of intellectual tasks: spatial learning, simple concept learning, complex concept learning. The performance of subjects using the DOA notetaking strategy was compared to subjects using their own covert internal learning strategy, while learning from printed instructional materials. The printed instructional materials consisted of a workbook providing information about the human heart. The printed information in the booklet was complemented with drawings of the heart. There were two types of booklets. The printed information was identical in both booklet types, in terms of content and organization. However, one booklet contained an illustration type drawing, and the other a line drawing. The instructional content in the booklets was designed to teach the names of the parts of the heart, and how the parts interact during heart operation, and the blood flow sequence during heart operation.

Experimental Design and Procedures

The experimental design of this study was a 2x2x3 analysis of variance, having two between-subjects variables and one within-subjects variable. The first between-subjects variable was type of notetaking strategy: directed overt activity strategy (DOA) and the covert activity strategy (CA). The second between-subjects variable was type of instructional booklet: line drawing instructional booklet and illustration instructional booklet. The within-subjects variable was type of intellectual task: spatial learning task, simple concept learning task, and complex concept learning task. The intellectual tasks were measured by three separate tests: identification test, terminology test, and comprehension test.

The first level of the notetaking strategy variable was the DOA notetaking strategy. Subjects in this condition were trained on how to use the DOA strategy in a 10-minute training period prior to receiving the instructional treatments. The purpose of the DOA strategy was to improve the learner's ability to abstract relevant information from the instructional booklet, for later performance on the three intellectual tasks. The key to the DOA strategy was to get the learner to actively respond to the information in the printed instructional materials. To accomplish this, the DOA strategy required the learner to respond on a notetaking sheet while reading through the instructional booklet. The notetaking sheet consisted of an 8x11 sheet with a drawing of the heart centered and filling up about two thirds of the sheet. The drawing of the heart was a blown-up version of exactly what was found in the instructional booklet except, of course, no labels, arrows, or text was provided. There were two types of notetaking sheets: an illustration sheet for those subjects using the illustration drawing booklet, and a line drawing sheet for those subjects using the line drawing booklet. In

addition to active responding, the notetaking sheet provided the necessary structure for helping the learner concentrate on the to-be-learned information in the instructional booklet.

The learner was instructed to use the notetaking sheet in the following way. First, while reading through the instructional booklet, when a heart part name and location was described the name was to be written on the notetaking sheet near the correct location. Secondly, an arrow was to be drawn indicating the exact spatial location of the part. Thirdly, the instructional booklet described the interaction of the parts during heart operation, this information was relevant and should be learned. The learner was instructed to draw a double-headed arrow indicating the set of two or three parts of the heart that interact during a specific heart operation. For example, the superior and inferior vena cava fills up the right auricle, forcing open the tricuspid valve. Thus an arrow would be drawn from the superior and inferior vena cava through the right auricle to the tricuspid valve. This procedure would be done while reading the instructional booklet until all the interacting parts were identified. Finally, it was important for the learner to understand the blood flow. So the subject was instructed to draw a dotted line through the major portions of the heart to indicate blood flow. The second level of the notetaking strategy variable was the covert activity strategy (CA). The CA strategy required the subject to read through the instructional booklet and attempt to process as much information as possible from the instructional booklet. The CA strategy allowed the learner to use his or her own information processing or learning strategy that is typically used during academic learning. Since many college level learners have developed learning strategies on their own, it is likely that these innate strategies could be as effective as a learning strategy imposed during the instructional situation.

The second between-subjects variable was the type of instructional booklet used during learning. There were two levels of the instructional booklet variable: line drawing booklet, and illustration drawing booklet. A variety of visual types are used to complement printed instructional materials, it is is likely that visual complexity could effect learning and the overall effectiveness of the DOA strategy or CA strategy.

The within-subjects variable was type of intellectual task. The spatial learning task was tested by the identification test. The identification test was a 20-item multiple choice test designed to test the spatial learning of heart part location. The test contained an illustration drawing of the heart with numbers where each part was located. The 20 items appeared under the numbered drawing and were all worded in the following manner:

Arrow number 4 points to the
a. pulmonary vein
b. pulmonary artery
c. aorta
d. tricuspid valve
e. mitral valve

The spatial learning intellectual task was considered the easier of the three tasks. The simple concept learning task was tested by the terminology test. The terminology test was a 20 item multiple choice test. Each item gave a critical attribute about a heart part or operation and the subject had to identify the part or operation. The items on the terminology test were worded in the following manner:

The tissue which protects the inside lining of the pericardium is called the _____.
a. extoxin
b. epicardium
c. endocardium
d. myocardium
e. ectocardium

The simple concept learning task was considered of intermediate difficulty, between the spatial learning task and complex concept learning task. The complex concept learning task was tested by the 20-item comprehension test. Each item on the comprehension test was designed to test the learner's knowledge of how the parts interact during heart functioning. The items on the test involve the interaction of two, three, or more simpler concepts about the heart, thus the name complex concept learning. The comprehension test is considered the most difficult of the three, and items on this test were worded in the following manner:

When impure blood is entering the superior vena cave, it is also entering the:
a. pulmonary veins
b. aortic arch
c. inferior vena cava
d. pulmonary artery

Subjects for the study were freshman psychology students from Ohio State University. Subjects participated in the study on a voluntary basis and received credit toward their final grade in their basic psychology course for participation. One hundred subjects signed up for the study. All subjects were given a pretest on human physiology and no subject had a score in excess of 35% correct on the pretest. Subjects were randomly distributed to type of instructional booklet, with 50 subjects in each of the two groups; illustration drawing booklet and line drawing booklet. From there, subjects were randomly distributed to type of notetaking strategy; DOA or CA. In each of the two groups of instructional booklet, 25 subjects used the DOA strategy, and 25 subjects used the CA strategy. Four separate classrooms were used so that each group of 25 subjects had no way of knowing what was going on with the other groups. Subjects in the DOA groups were given training on how to use the DOA strategy during the first 10 minutes of their session. A set of instructions was read to the DOA groups on how to use the strategy, so each of the two groups received identical instruction. The instructional booklets and notetaking sheets were then administered and subjects had 25 minutes to study the booklets while using the DOA strategy. At the end of the 25 minute study period, all instructional booklets and notetaking sheets were collected

and the test battery of three tests was administered. Subjects were given 45 minutes to complete the test battery. Subjects in the CA strategy were told to use their normal study strategy when studying the instructional booklet. This was explained as the typical study strategy they use when in a lecture or studying textbook material on their own. The CA subjects were then given 25 minutes to study the instructional booklet. At the end of the 25 minute period, all instructional booklets and any written notes were collected by the experimenters. The test battery was then administered, subjects were given 45 minutes to complete the test battery.

Results

The resulting analysis of variance appears in Table 1. Statistically significant results failed to occur on the two between-subjects variables of strategy and instructional booklet and their interaction. This indicated that the visual type difference of line drawing or illustration did not effect learning and had no effect on strategy type used. However, there was a significant interaction between intellectual task and strategy, which could account for the lack of statistical difference between the overall DOA mean and CA mean. The within-subjects variable of intellectual task yielded a statistically significant F-ratio ($F(2,192\ Df) = 64.701$, $p<.0001$). A Tukey follow-up test set at a significance level of .01 was conducted to find the mean differences between the spatial task, the simple concept task, and the complex concept task. The spatial task mean ($\bar{x} = 14.06$) differed significantly from the simple concept task mean ($\bar{x} = 11.56$) and the complex concept task mean ($\bar{x} = 10.65$). The simple concept mean did not differ significantly from the complex concept task mean. This result indicated that the spatial task was in fact the easier of the three intellectual tasks. While the difference between the simple concept task mean was not statistically different, the complex concept mean ($\bar{x} = 10.65$) was lower than the simple concept mean of ($\bar{x} = 11.56$) indicting that the complex concept task was slightly more difficult.

The interaction between the strategy variable and intellectual task variable resulted in a significant F-ratio ($F(2,192\ Df) = 15.523$, $p<.04$). The means involved in the significant interaction appear in Table 2. The significant interaction is graphically displayed in Figure 1. A Tukey follow-up test, with a significance level of .05, was conducted on the resulting means to locate the source of the interaction. Looking at the DOA strategy level finds a statistical difference between the spatial task mean ($\bar{x} = 13.9$) and both the simple concept task mean ($\bar{x} = 11.16$) and the complex concept task mean ($\bar{x} = 11.02$). However, the simple concept task mean ($\bar{x} = 11.16$) and complex concept task mean ($\bar{x} = 11.02$) did not differ statistically. Looking at the CA strategy finds the source of the interaction. Similar to the DOA level, at the CA level the spatial task mean ($\bar{x} = 14.22$) differs significantly from both the simple concept task mean ($\bar{x} = 11.96$), and the complex concept task mean ($\bar{x} = 10.28$). However, unlike the DOA level, at the CA level there is a statistical difference between the simple concept mean ($\bar{x} = 11.96$) and the complex concept mean ($\bar{x} = 10.28$). The source of the interaction is this difference between the simple concept mean and complex concept mean at the CA strategy level.

This result indicates that as intellectual task difficulty increased subjects using the DOA strategy had an information processing advantage over subjects in the CA group using their own innate strategy. Subjects using their own strategy in the CA group performed quite well on the spatial learning task and simple concept learning task. However, the DOA group was able to abstract and retain more information from the instructional booklet about how the parts of the heart interact during the hearts operation than the CA group. While both groups performed well at the less difficult side of the intellectual task scale, the DOA strategy allowed subjects to identify important information to help them perform on the more difficult intellectual task.

Conclusions and Further Research

The directed overt activity notetaking strategy addressed three key elements that facilitated the cognitive processing of information. First, the use of the notetaking sheet provided a structure for the learner to help effectively organize new to-be-learned information. As Hartley and Davies (1976) indicated, this organizing principle is a significant aspect of learning via notetaking. Secondly, the DOA strategy directed the learner to identify relevant information from the instructional booklets that would be needed to successfully perform on the three intellectual tasks. Thus the learner is not left to his or her own decision making, as is often the case, on identifying what should be learned and what will be needed for test performance. Finally, the DOA strategy forces the learner to be intellectually active during the study phase of learning. The learner is not passively reading or passively taking notes, but must be active intellectually to complete the notetaking sheet while interacting with the instructional materials. The CA strategy and DOA strategy probably did not differ on the less difficult intellectual tasks because the CA group's own study strategies were relatively effective. Keep in mind here that the subjects were all beginning college level students who must have developed reasonably effective study strategies for this level of academic development. It is likely that high school and technical school students may benefit more from such imposed strategies. However as intellectual task difficulty increased, even slightly, the DOA strategy group significantly outperformed the CA group.

Of course, in this study the notetaking sheet, intellectual tasks, and printed instructional materials, were matched on a one-to-one basis, however the basic elements involved in the DOA strategy could be used for almost any type of print or lecture instructional materials. This would require the instructor to develop some type of notetaking sheets or handout packs for each lecture. The notetaking sheets would provide the organization or structure needed to effectively interact with the lecture. Of course, learners would have to be given instructions on how to interact with the notetaking sheets and the lecture. Finally, it would be necessary to organize the lecture quite well, and pace the lecture so students can follow along and continue to respond on their notetaking sheets. This type of notetaking strategy, to aid the learner in acquiring information during the lecture, has been tried at Penn State Engineering in a Civil Engineering course (Kilareski, Canelos, Keinschmidt, 1982). In

this Civil Engineering course, a supplementary text was developed that consisted of a series of notetaking sheets for each lecture. These notetaking sheets required the learner to write in definitions, complete equations, solve simple problems, solve complex problems, and complete diagrams, during the 50-minute lecture. Some of these activities were simple "fill in the blank" type of tasks; others required complex problem solving. However, the key here is that the notetaking sheets kept learners intellectually active during the lecture, provided a structure, and identified important material that should be learned. Both students and faculty responded quite well to the Civil Engineering course notetaking methodology.

A similar notetaking approach was developed for an Engineering Science and Mechanics course at Penn State Engineering (Rytel, 1984). In this course, the notetaking sheets were designed to complement television instructional materials. They were referred to as Lecture Notes and were developed into a workbook format. The purpose of the Lecture Notes workbook, in the Engineering Science and Mechanics course, was to insure that students would be active while viewing the television lessons. Similar to the Civil Engineering methodology, the Lecture Notes required students to write in definitions, complete equations, develop illustrations and diagrams, and solve simple problems. In the Engineering Science and Mechanics course, students responded quite favorably to the Lecture Notes, and the method does improve learning from the Engineering Science and Mechanics television instructional materials.

These two applied examples of the use of a DOA type of notetaking strategy further confirms the positive effects upon learning of a notetaking strategy designed to: keep students intellectually active during the instructional sequence, point out relevant to-be-learned material, and provide a structure or organizing principle. Further studies in this area should consider the effects of similar notetaking strategies when learning from different presentation modes such as lecture methods, video based instruction, and computer based instruction. Additionally, since it is likely that high school and technical school students would benefit from learning notetaking strategies, such strategies should be further refined and tested using such students as subjects. Most high school level students have not yet developed learning and notetaking strategies that are effective and efficient. Further, primary level students and junior high level students would also benefit greatly from learning effective notetaking strategies if they were available. It has always been an amazing paradox that so much is known about learning strategies, of an external and internal nature, but few students are ever given formal instruction on these "learning how to learn" methodologies. Perhaps further applied research would tend to correct this serious pedagogical problem.

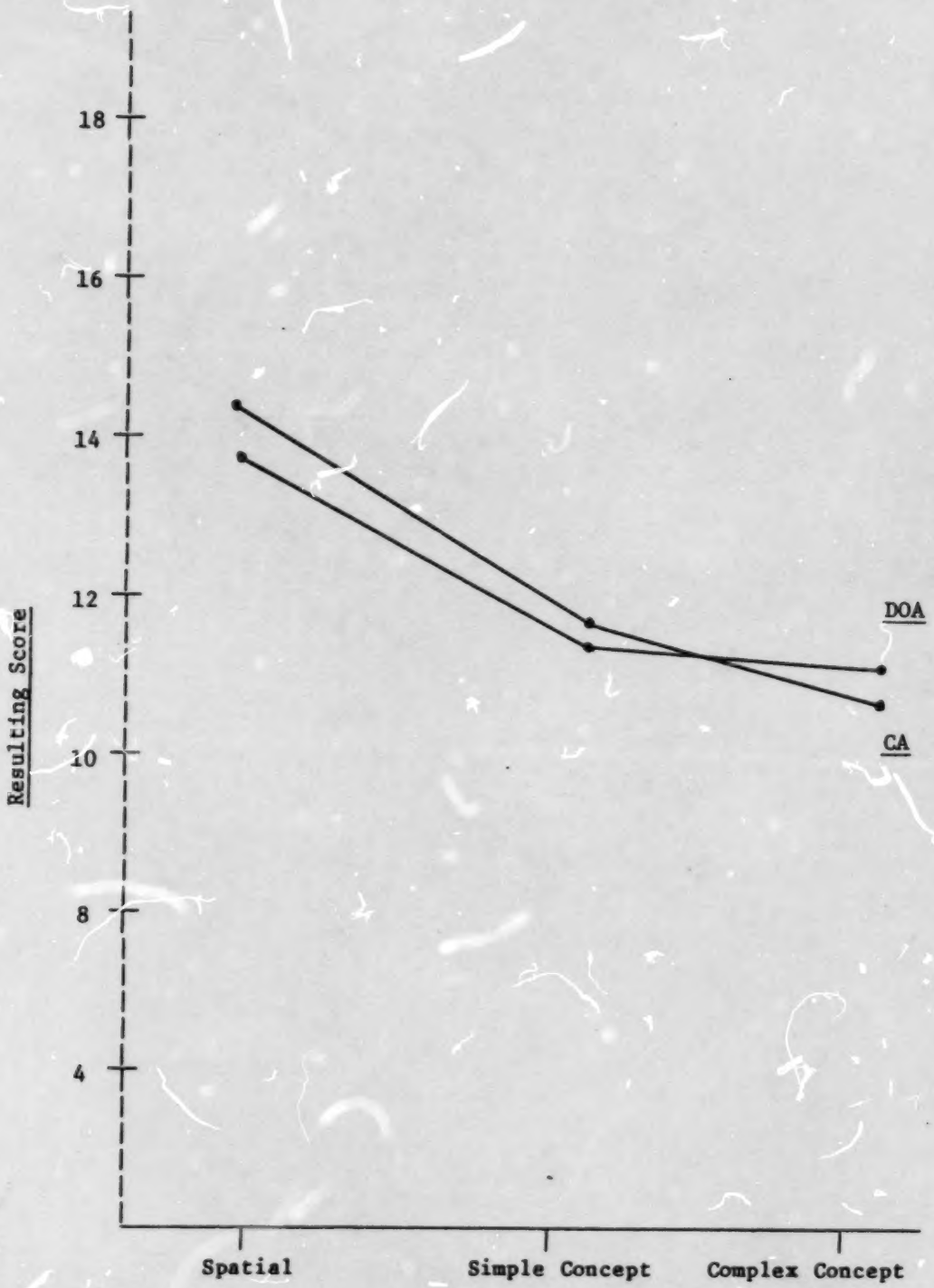

Figure 1: Resulting Disordinal Interaction.

Table 1: Resulting Analysis of Variance.

Source	Mean Squares	Df	f-Ratio	Probability
Strategy (A)	1.203	1	0.029	.86
Booklet (B)	76.003	1	1.823	.18
(A) x (B)	42.563	1	1.021	.31
error	41.681	96	—	
Intellectual Task (C)	311.770	2	64.701	.0001
(A) x (C)	15.523	2	3.222	.042
(B) x (C)	4.263	2	0.885	.41
(A) x (B) x (C)	3.523	2	0.731	.48
error	4.819	192	—	

Table 2: Strategy by Intellectual Task Interaction Table of Means

	Spatial Task	Simple Concept Task	Complex Concept Task
DOA	13.90	11.16	11.02
CA	14.22	11.96	10.28

References

Bower, G. H. How To ... Uh ... Remember. Psychology Today, October, 1973.

Bugelski, B. P Words and Things and Images. American Psychologist, 1970, 25, 1002-1012.

Canelos, J. Project Evaluation Report: Television Based Learning In Electrical Engineering 368 and 271, Unpublished paper, College of Engineering, The Pennsylvania State University, University Park, PA, 1983.

Dansereau, D. F., McDonald, B.A., Collins, K. W., Garland, J., Holley, D. C., Diekhoff, G. M., Evans, S. H., Evaluation of a Learning Strategy System, in O'Neil, H. F. Jr. and Spielberger, C. D., Cognitive and Affective Learning Strategies, N.Y.: Academic Press, 1979.

Ganske, L. Note-Taking: A Significant and Integral Part of Learning Environments, Educational Communication and Technology Journal, 1981, 29(3), 155-175.

Hartley, J., and Davies, I. K. Notetaking. Unpublished paper, Department of Psychology, Keele University, England, 1976.

Kilareski, W. P., Canelos, J., Reinschmidt, A. J. An Instructional Development Project Addressing a Crises Learning Situation in Civil Engineering at Penn State, 1982 Frontiers In Education Conference Proceedings, 1982, 12, 202-208.

O'Neil, H. F., Jr. Learning Strategies, N.Y.: Academic Press, 1979.

Paivio, A. On the Functional Significance of Imagery. Psychological Bulletin, 1970, 73, 385-392.

Pytel, A. Lecture Notes and Video Instruction, Issues in Higher Education, Vol. XIV, in press, 1984.

Rohwer, W. D., Jr. Images and Pictures in Children's Learning: Research Results and Educational Implications. Psychological Bulletin, 1970, 73, 393-403.